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Investigation of Interoperability Mechanisms Between C3I Projects: The Strategic Client Demonstrator

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ABSTRACT

This report describes the demonstration of several potentially useful concepts in the Command and Control Information System Interoperability Laboratory (CCISIL). These go some way toward addressing the problem of ADF staff requiring access to more than one system. A new potential capability is demonstrated to achieve a moderate level of integration between AUSTACSS and JCSE for sites that are running both systems. This work reveals some problems that can occur as a result of using remote execution, particularly for applications with high levels of customisation or integration as is the case for the current build of AUSTACSS. An ability to use either AUSTACSS or JCSE from a commercial PC X emulation package is demonstrated, and some performance measures are discussed.

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Investigation of Interoperability Mechanisms Between C3I Projects: The Strategic Client Demonstrator

Executive Summary

The Strategic Client Demonstrator concept seeks to address a major problem facing users of current C3I related systems: that the user often requires access to more than one system, and, therefore, may need to accommodate more than one computer on his or her desk. This situation causes waste of resources and is less than optimal from a useablility viewpoint.

The first stage of this project aimed to demonstrate the feasibility of accessing multiple systems (such as JP2030 and AUSTACSS) from a single UNIX workstation. Phase one work was initially intended as a tool to gain user requirements for interoperability between the JP2030 and AUSTACSS systems. Those requirements were to feed into a subsequent phase, to demonstrate a useful level of application interoperability between the two systems.

This report describes the demonstration of several potentially useful concepts in the Command and Control Information System Interoperability Laboratory (CCISIL). These go some way toward addressing the problem of ADF staff requiring more than one computer on their desk. A new capability is demonstrated to achieve a moderate level of integration between AUSTACSS and JCSE for sites that are running both systems. This work reveals some problems that can occur as a result of using remote execution, particularly for applications with high levels of customisation or integration as is the case for the current build of AUSTACSS. The Strategic Client Demonstrator is a stop gap measure. It does not display a high level of application interoperability, nor is it optimal in terms of useability. From the users perspective, there should be one integrated system that contains the correct and up to date information.

Another, related part of this research is to demonstrate access to the JCSE and AUSTACSS software from a Windows 95 based X emulation program. An ability to use either AUSTACSS or JCSE from a commercial PC X emulation package is demonstrated. Performance measurements indicate that both remote execution and PC emulation provide reasonable response times, provided that the network is not overloaded. Further, an analysis of the CPU utilisation of the host during a high activity period would indicate that there is potential for several PCs to run off a server, and possibly more from a suitably configured server.

Contents

1. Introduction

The Strategic Client Demonstrator concept seeks to address a major problem facing users of current C3I related systems: that the user often requires access to more than one system, and, therefore, may need to accommodate more than one computer on his or her desk. This situation causes waste of resources and is less than optimal from a useablility viewpoint.

The first stage of this project aimed to demonstrate the feasibility of accessing multiple systems (such as JP2030 and AUSTACSS) from a single UNIX workstation. Another part of this research is to demonstrate access to the JCSE and AUSTACSS software from a Windows95 based X emulation program. Phase one work was initially intended as a tool to gain user requirements for interoperability between the JP2030 and AUSTACSS systems. Those requirements were to feed into a subsequent phase, to demonstrate a useful level of application interoperability between the two systems.

The Strategic Client Demonstrator is a stop gap measure. It does not display a high level of application interoperability, nor is it optimal in terms of useability. From the users perspective, there should be one integrated system that contains the correct and up to date information.

This work is being carried out under task ADF 96/182 'CCISIL Research'[1], and is in addition to the ongoing work of verifiying and documenting the baseline interoperability delivered by the two Projects [2].

Following the 26th September 1996 meeting with the task's sponsor, the direction of this work was modified. The first phase developed the ability to demonstrate access to AUSTACSS and JP2030 from a single UNIX workstation, but the later work is targeted toward investigating the ability to port one or both of the project systems to a different platform. The aim of the second phase is to demonstrate AUSTACSS and JP2030 running on the same hardware.

It should be noted that the work reported here was performed using AUSTACSS Build 2/3 release 1.1 and JCSE version 2.0.2a. Unless otherwise stated, all comments refer to these versions of the software.

2. Remote Execution of Project Software

2.1 CCISIL Setup

During the work described in this report, the AUSTACSS and JP2030 systems were installed in the CCISIL on a common ethernet LAN, see Figure 1.

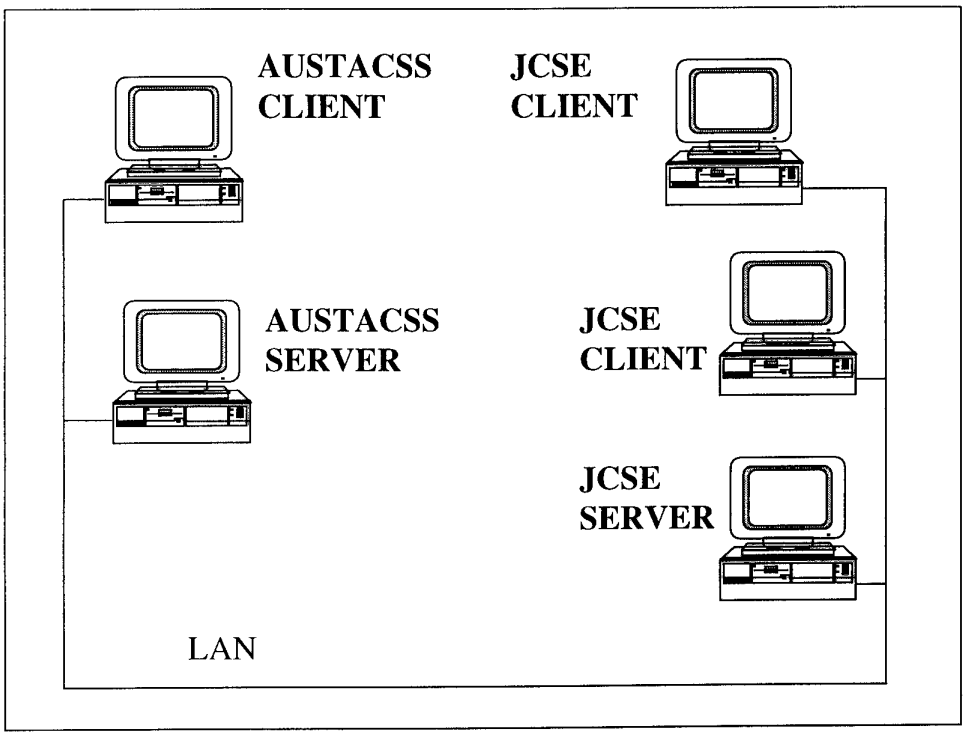

Figure 1: CCISIL Setup for remote execution demonstration

The two systems were configured on different subnets. This was not a problem because routeing software was running on the AUSTACSS server.

2.2 Changes required

In order to demonstrate access to both systems, it was necessary to enable a user to remotely log into the other system. For example, an AUSTACSS user can display both the AUSTACSS Battlemap and the JP2030 Picture Manager at the same time. While in principle this is a trivial task, in practice there were a number of complicating factors:

1) The AUSTACSS users do not have access to a command line (xterm) to perform remote logins.

2) There is resource contention when displaying non-project software on the workstation.

3) Many environment variables need to be initialised before the remote software can be executed.

Solving these problems without comprehensive documentation takes time. For the purpose of investigating and demonstrating the concept the following applications were made available to users:

AUSTACSS users could run the following JCSE applications
- Applix word.
- Picture Manager
- Message Queue Manager
- Lotus Notes

JCSE users could run the following AUSTACSS applications
- Applix word
- Battlemap
- Message History
- Filer

In most cases, in both JCSE and AUSTACSS, these applications are started from the CDE/HP VUE menu bar. The look of this menu bar is defined by several scripts that reside in the filesystem. In order to provide a simple method for the user to execute the remote software, these scripts were modified. A control with several icons was added to the menu bar so that the user could simply click the icon and the remote software would be started and displayed. As stated above, this script logs in to the remote system, sets many environment variables and then runs the required application. In order to prevent passwords from being stored in the scripts, the user account SO1OPS in AUSTACSS and a user account called ccisil1 in JCSE were set up so that a password was not required to log from one to the other.

Note that this approach does not require the user to log in to the remote computer using an xterminal and so problem 1) above is avoided.

2.3 Results of AUSTACSS to JCSE remote execution

Figure 2 depicts an example session where an AUSTACSS user has access to both the AUSTACSS Battlemap and the JCSE Picture Manager. In this case

the user has been able to cut graphics from both mapping systems into a single document.

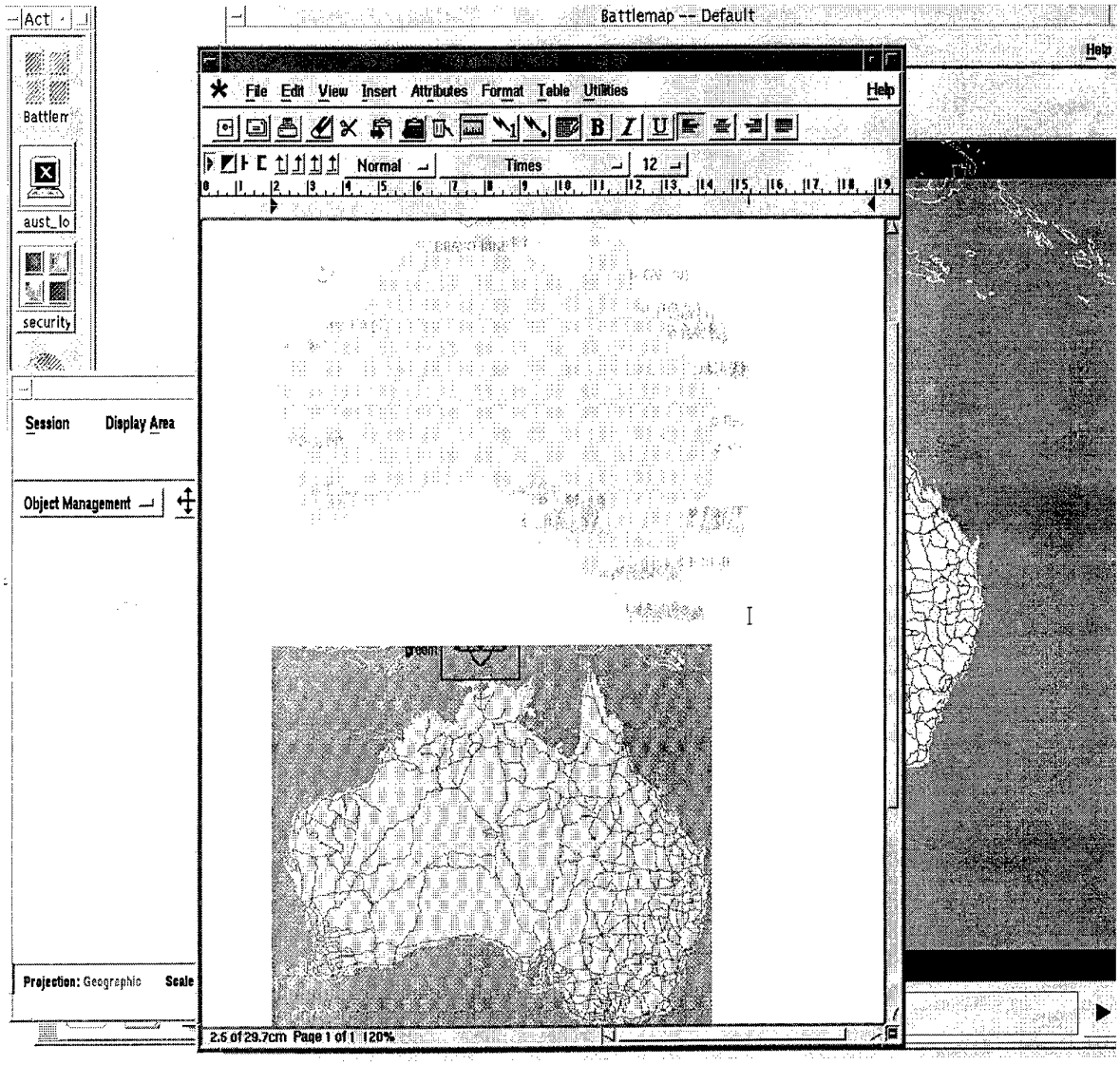

Figure 2: Remote execution demonstration from AUSTACSS

All of the attempted JCSE applications (Applix word, Picture Manager, Message Queue Manager, Lotus Notes), were able to be run from AUSTACSS. It was possible to cut bitmaps from both Mapping packages and paste them into an Applix document. It was possible to cut text from an AUSTACSS message and paste it into a Lotus Notes email, and transmit the information to other JCSE users. However, several problems were experienced during the modification and testing of these features.

2.3.1 Problems with Colours in AUSTACSS

There were several problems with colourmaps during the investigation. The JCSE Picture Manager attempts to define the colour "black" at startup and fails, so the background is displayed as white instead of black. This is unacceptable because when a Picture Manager track is selected, it is displayed in white and thus cannot be seen against the white background.

2.3.2 Problems with Resources in AUSTACSS

Because the software was running remotely, all information to be displayed had to be transmitted over the network. That tended to slow down the response time (performance results are presented in Section 2.6). In addition, the processing power and memory of the remote computer was being utilised. Both JCSE and AUSTACSS have stringent memory requirements associated with the mapping packages. This situation was complicated by the fact that when a user exited a remote program, the display connection was terminated. On some occasions the display connection was terminated before the remote program had time to shut down completely. If this process of running and exiting the remote mapping package was repeated, the remote workstation soon ran out of swap space and was unable to restart the mapping package. This situation can be resolved by terminating some of the unwanted processes, which could be automated in a script for future demonstrations.

2.4 Results of JCSE to AUSTACSS remote execution

Figure 3 depicts an example session where a JCSE user has access to both the AUSTACSS Battlemap and the JCSE Picture Manager.

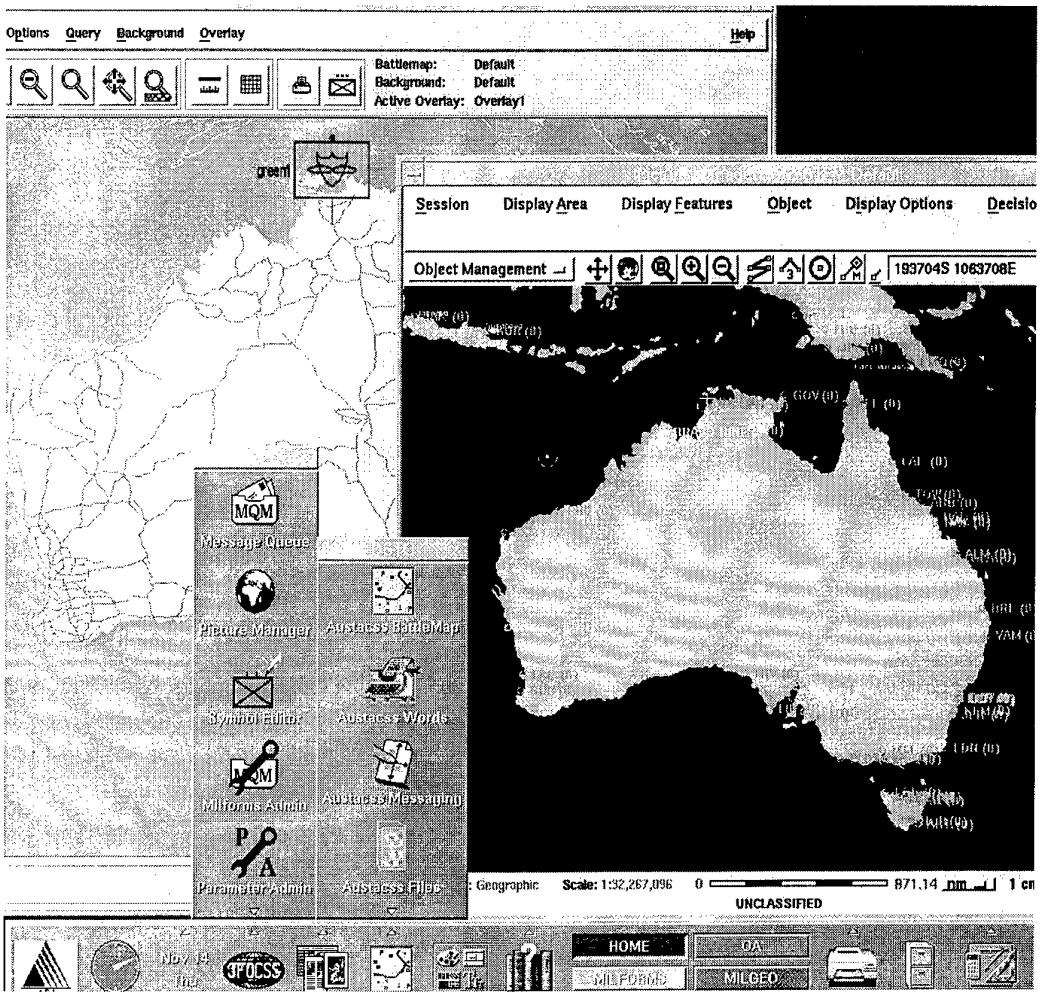

Figure 3: Remote execution demonstration from JCSE

All of the attempted AUSTACSS applications (Applix word, Battlemap, Message History, Filer), were able to be run from JCSE. There were however, some additional problems. One of the features of AUSTACSS is that the messaging application is tightly integrated with Applix word, the Filer application and the Database. For example, to send a message in AUSTACSS, the user normally writes the message text in an Applix Word document, drags and drops the file icon for the document on the Mail icon. The messaging application is then automatically invoked. This presents a problem for the remote execution approach, because several aspects of the CDE functionality have been customised in AUSTACSS, but the customisation is not available in JCSE. For example. although the AUSTACSS Filer application can be seen from JCSE, and the directory structure can be viewed and traversed, if the user double clicks on a document in the filer, Applix Word will not be invoked to edit the document. In fact, the Filer will disappear because an error has occurred. This problem may be able to be rectified by further modifying the AUSTACSS scripts to recognise that a

remote request has been received. This example highlights some limitations of the remote execution approach.

2.5 Problems with the Remote Execution Approach

In addition to the problems presented in Section 2.3 and 2.4, there are potential software engineering difficulties. At this point the Demonstrator illustrates potential capability. However, implementing it in an operational system will present difficulties in the areas of configuration management and ongoing maintenance. First of all, staff will need training in both systems. Second, there are problems resulting from the dependencies between the two systems. For example, systems are sometimes upgraded to a new release. This may cause a failure when the older system on the other end attempts to run it remotely.

Therefore, remote execution should be seen only as a stop-gap measure while trying to provide for the user's real requirement: access to one integrated system. Another consequence of this capability is that users may require training on both systems.

2.6 Performance Results for the Remote Execution Approach

Table 1: Performance Comparison for Remote Execution

Operation	JCSE	Remote Execution	% Increase
Start Picture Manager	1:56	1:54	-1.7
Zoom in Picture Manager	0:09	0:06	-33.3
Page down in JCSE Word	0:06	0:09	50.0
	AUSTACSS		
Start Battlemap	0:42	0:52	20.0
Zoom in Battlemap	0:05	0:08	60.0
Page down in AUSTACSS Word	0:08	0:11	37.5

Table 1. shows the relative performance of remote and local execution of several applications. As shown, remote execution is not significantly slower than when logged in directly, and the performance of some JCSE applications unexpectedly improved when run remotely.

When Table 1 is compared with the performance results presented in Section 3 below, it would appear that

- JCSE is under high CPU utilisation during these activities and some of the processing is unloaded to the remote machine during remote execution.

- Although the CPU utilisation is high, it is not 100% as in the case of AUSTACSS, so it may be that the JCSE workstation is spending a lot of time swapping data between memory and disk. Having the information displayed remotely may reduce this memory swapping and further increase performance.

- On the surface, it would appear that the AUSTACSS workstation is faster than the JCSE workstation, which would also increase the display speed when a JCSE application is being displayed on an AUSTACSS workstation.

It should be noted that these performance measurements were taken for a specific system configuration. In particular, the CCISIL was set up with a small number of workstations on a dedicated LAN which thus has a very low level of network traffic. As network traffic increases, a corresponding decrease in performance would be expected.

These figures are not intended to make comparisons between AUSTACSS and JCSE, and should not be used to do so. There are many variables such as the level of map detail, and performance of the hardware installed in the CCISIL which make such a comparison meaningless.

3. PC X Emulation Software

Defence already operates a number of PC based LANs. FEPCIS is an example of such a network. The combination of those LANs and the new availability of high quality X emulation software packages, makes it possible to offer a low cost platform to access AUSTACSS or JCSE. Some users may see this as a value-add to their existing capabilities.

The Strategic Client Demonstrator project investigated the ability of several X emulation packages to log into and run JCSE and AUSTACSS.

3.1 CCISIL Setup and Methodology

For this investigation, the CCISIL was set up as shown in Figure 4

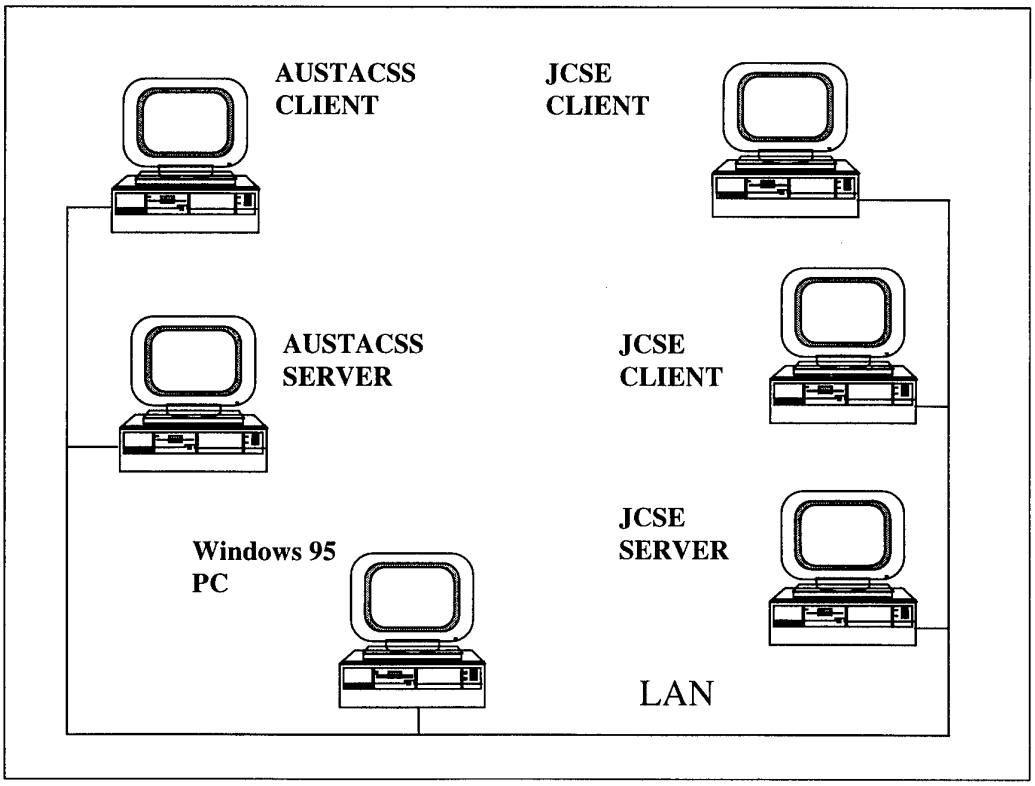

Figure 4: CCISIL Setup for X emulation investigation

A Windows 95 based PC was connected to the same LAN as the two C3I systems. Three separate PC X emulation packages were evaluated:

- Xwin32 version 3.2.8 by StarNet Communications corp.
- eXodus version 5.6.4 by White Pine software.

- eXceed version 5.1.1 by Hummingbird.

The PC was configured with 32 Megabytes of RAM and a Pentium processor. The screen was set to the 1280 by 1024 mode so that when the PC was logged into a UNIX system, the display looked identical to the local UNIX display.

An attempt was made to login to JCSE and AUSTACSS from the PC and run the GIS, messaging and Office Automation software.

3.1.1 PC X Emulation Performance Test

The response times of JCSE and AUSTACSS were measured for various tasks, to get an indication of achievable performance using PC X emulation. These tasks include:

- Log in to the system from the CDE / HP VUE
- Start the mapping package
- Zoom in to Tasmania from Australia in the mapping package
- Page down in a test document in Applix Word

The times were measured using a stopwatch.

3.1.2 CPU Utilisation Test

A test was conducted on both AUSTACSS and JCSE, to determine the level of CPU usage while a user was logged in from the PC. For this test the eXodus X emulation package was used. The CPU utilisation was recorded using the vmstat command, which in this case wrote the average CPU usage every 5 seconds. This test was intended to be representative of a high usage period by the PC user while no other activity was occurring in the system. The basic sequence of events are as follows:

- Log into system from DCE/HP VUE screen
- Start the mapping application
- Zoom into Tasmania from a view of Australia
- Start Applix Word
- Open the test document (which contains several large bitmaps and pages of text).
- Page down through the test document

The timings for each of these activities are given in the results section so that they can be compared with the peaks on the CPU utilisation graphs. Note that the PC was logged into the JCSE or AUSTACSS server for these measurements.

3.2 Results for PC X emulation

Both JCSE and AUSTACSS were able to be run remotely from a PC. Apart from performance, the look and feel of the C3I systems was identical to the normal workstation displays. The performance in both cases was noteably slower than that experienced when logging in directly to the workstation. The Xwin32 software was unable to log into the AUSTACSS system. The reasons for this are unknown and thought to be the result of errors in the Xwin32 software. It was noted, however,

that the Xwin32 package could log into another computer running the Solaris 2.5 operating system.

The JCSE Picture Manager provided a challenge for the X emulation packages. This is because the Picture Manager software writes track symbols and other graphics to the screen on top of mapping graphics drawn by the Genasys software. Picture Manager relies on the X server to store a copy of the display under such symbols and restore them when required. The Xwin32 software does not appear to provide this capability, and the eXceed package needed to be re-configured in order to support this. If the display underneath is not stored, as with Xwin32, the resulting display has large areas of random colour.

3.3 Performance Results for PC X emulation

Table 2. Provides a comparison of the performance of each of the X emulation packages, with that experienced when logged into the workstation.

Table 2: Performance comparison for X emulation packages

Operation	JCSE	Xwin32	eXodus	eXceed	Average % Increase
Log in to JCSE	0:40	1:14	0:46	0:57	47.5
Start Picture Manager	1:56	2:02	1:58	1:58	28.7
Zoom in Picture Manager	0:09	0:15	0:19	0:16	85.2
Scroll down in JCSE Word	0:06	NA	0:10	0:11	75.0
	AUST-ACSS				
Log in to AUSTACSS	0:36	NA	0:44	0:56	38.8
Start Battlemap	0:42	NA	0:52	0:52	23.8
Zoom in Battlemap	0:05	NA	0:11	0:10	110.0
Scroll down in AUSTACSS Word	0:08	NA	0:12	0:11	43.8

Although the response time is significantly slower, particularly for zooming in the mapping packages, it is thought to be reasonable. As in the case of remote execution, these performance figures were obtained with a lightly loaded network. Network traffic will effect the response time.

Figure 7 and Table 3 describe the CPU utilisation test results for AUSTACSS, while Figure 8 and Table 4 describe those for JCSE. It can be seen that the periods of highest activity for both systems is during login and starting the mapping packages. Note that the AUSTACSS system reaches full CPU utilisation several times during the test.

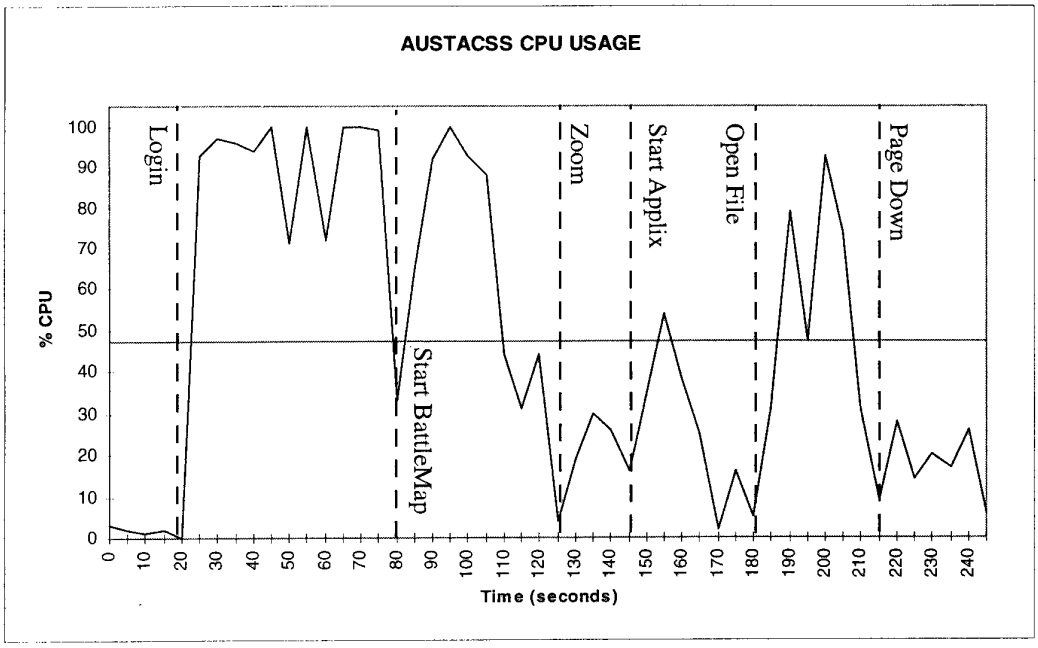

Figure 5: % CPU Usage X emulation of AUSTACSS (eXodus)

Table 3: Actions completed during AUSTACSS CPU utilisation test

Action	Relative start (seconds)
Login	20
Start BattleMap	80
Zoom in BattleMap	125
Start Applix Word	145
Open test file	180
Page to bottom of test file	215
Finish	245

The JCSE system does not reach full CPU utilisation during this test, indicating that system may be slowed down by a lack of real memory, disk speed, network bandwidth or the time the PC is taking to display the information.

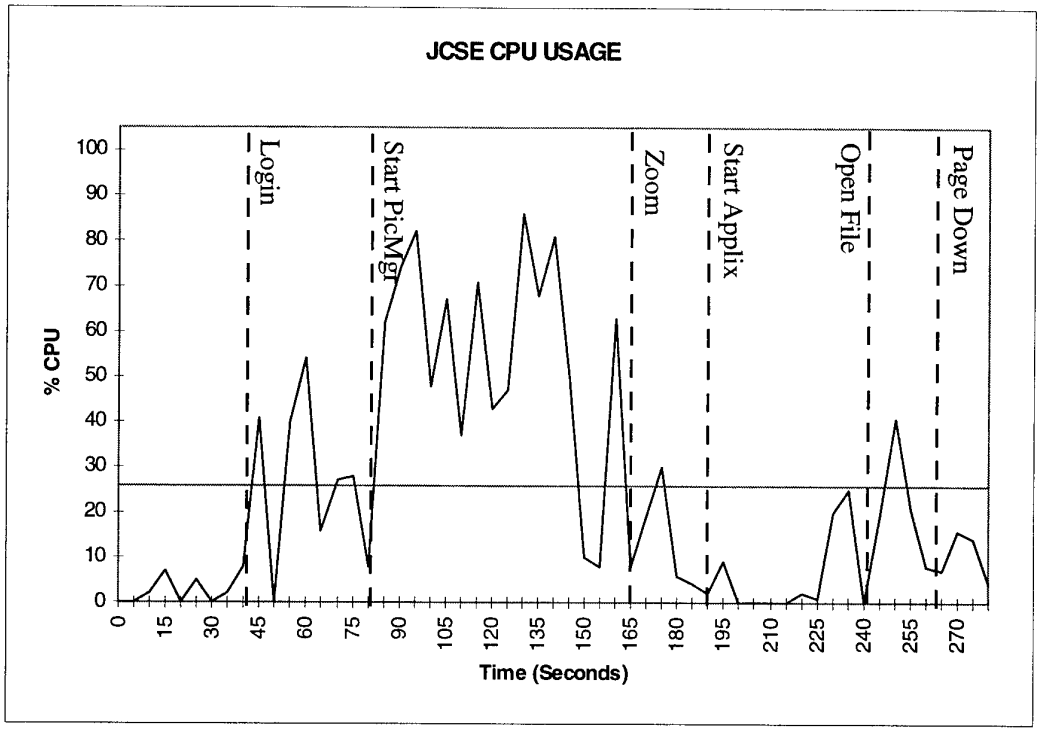

Figure 6: % CPU Usage X emulation of JCSE (eXodus)

Table 4: Actions completed during JCSE CPU utilisation test

Action	Relative start (seconds)
Login	39
Start Picture Manager	80
Zoom in Picture Manager	165
Start Applix Word	190
Open test file	240
Page to bottom of test file	263
Finish	279

These results indicate that there is some room for more than one PC to run off a single workstation or server, particularly as the measurements were taken during a period of high activity. Clearly if many PCs were to be run from a single server, a high powered CPU and more memory would be required.

4. Conclusions

This report has described the demonstration of several potentially useful concepts in the CCISIL, which go some way toward addressing the problem of ADF staff requiring access to more than one system. A new capability has been demonstrated to achieve a moderate level of integration between AUSTACSS and JCSE for sites that are running both systems. This work has revealed the problems that can occur as a result of using remote execution, particularly for applications with high levels of customisation or integration as is the case for the current build of AUSTACSS.

An ability to use either AUSTACSS or JCSE from a commercial PC X emulation package has been demonstrated. Performance measurements indicate that both remote execution and PC emulation provide reasonable response times, provided that the network is not overloaded. Further, an analysis of the CPU utilisation of the host during a high activity period would indicate that there is potential for several PCs to run off a server, and possibly more from a suitably configured server.

5. References

1. J. Mansfield, 'TASK PLAN ADF 96/182:CCIS Interoperability Laboratory Research', DSTO, 19 June 1996.
2. B. McClure, 'Interoperability between AUSTACSS and JCSE: Messaging, ADFORMS and OFFICE Automation', DSTO Client Report September 1996.

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Library	1

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Windows operating system

19. ABSTRACT

This report describes the demonstration of several potentially useful concepts in the CCISIL. These go some way toward addressing the problem of ADF staff requiring access to more than one system. A new potential capability is demonstrated to achieve a moderate level of integration between AUSTACSS and JCSE for sites that are running both systems. This work reveals some problems that can occur as a result of using remote execution, particularly for applications with high levels of customisation or integration as is the case for the current build of AUSTACSS. An ability to use either AUSTACSS or JCSE from a commercial PC X emulation package is demonstrated, and some performance measures are discussed.